Subgroup 1 Charge:

A. Address the state-of-the-science and the importance of various processes in the formation of hypoxia in the Gulf of Mexico. These issues include:

i. increased volume or funneling of fresh water discharges

ii. changes in hydrologic or geomorphic processes

iii. increased nutrient loads due to coastal wetlands losses, upwelling or increased loadings from the Basin

iv. increased stratification, and seasonal changes in magnitude and spatial distribution of stratification and nutrient concentrations in the Gulf;

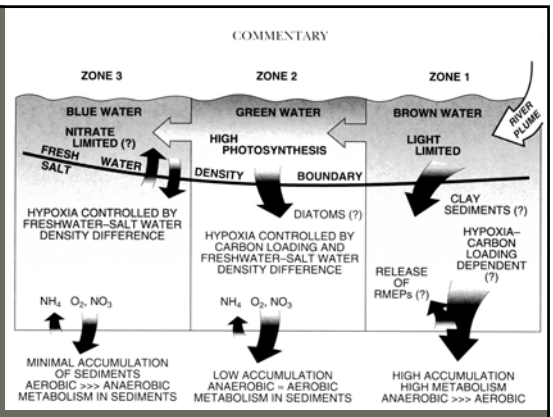
v. temporal and spatial changes in nutrient limitation, as significant factors in hypoxic zone formation;

vi. the implications of reduction of phosphorus or nitrogen without concomitant reduction of the other.

B. Comment on the state of the science for characterizing the onset, volume, extent and duration of the hypoxic zone.

Physical context:

Rowe and Chapman (2002): Three different regions to consider; physical and biogeochemical processes are different in each. Physical factors significant in determining hypoxia duration, extent



Plume-induced stratification a strong control over hypoxia, contributes to regional circulation.

Stratification near bottom/loss of O_2 at this interface also important process.

Duration quite variable, driven by shifts in plume and changes in stratification.

Circulation:

Regional circulation driven by Loop Current and its Eddy System, but local processes, particularly wind, more important in shallower regions.

Bird's foot blocks along-isobath flow, creates two cells.

Smith and Jacobs (2005): spring/summer flows weak, variable, generally W to E.

Zavula et al. (2003): E to W near-coast, except July.

Inshore of 50 m isobath, strongly wind/weather driven.

Still needed:

Tidal dissipation and its role

Status and validity of physical circulation and mixing models

Carbon loads

Carbon inputs: both terrestrial and autochthonous; variable estimates of burial, reactivity.

Mobile muds important in moving C on shelf and beyond. Some C utilized in this layer; some buried, some removed from shelf.

Changes (decreases) in sediment loads, wetlands losses over past 50 years. Disagreement in amount of OC from wetland loss—from an insignificant C source to a highly significant one.

Ms. River major source of DOC to shelf; also significant in situ production

Terrestrial, sediment, and autochthonous inputs necessary to drive current hypoxic extents

Still needed:

Better understanding role of C from eroding wetlands, other terrestrial sources: relative lability, % utilization, transport, burial?

Consensus re: relative loads of terrestrial OC vs. autochthonous OC

Are the differences in OC degradation in the western region of the hypoxic zone (relative to eastern region) important to management questions – or focus on the near-plume effects where hypoxia occurs most frequently?

Nutrient inputs and cycling

- Substantial inputs of N and P from Basin enhance primary production; spatially and temporally variable. Also significant loads from offshore, atmospheric deposition.
- Variability in loads and transparency modulate the production of C, and its fate in these three zones on the shelf
- Role of denitrification? Significant relative to P burial?
- Role of wetlands in altering nutrient loads under debate
- Substantial fraction of P is particle bound. What is its fate? Low bioavailability in freshwater, but desorbed and available on the shelf?

N vs P

- Molar ratios vary between 5 and 300; also flushing rates, light, turbidity, recycling rates all influence nutrient uptake and limitation; Rowe and Chapman zones likely different in times and extent of N and P limitation, with inshore areas strongly P limited during important spring/summer period, and offshore N limited.
- Still in question: how these zones differ in their contributions to extent of hypoxia.
- What is the linkage between high primary production inshore and hypoxia located further offshore?

Role of Si

- Increases in N and P have altered N:Si, P:Si ratios. Strong potential for shifts in phytoplankton species composition, and likely shifts in C utilization by higher trophic levels.
- Questions about how these shifts may alter resource species, also their inputs/impacts on hypoxia

Reduce N and/or P?

- N fluxes from Basin have decreased in recent updates, but P fluxes have increased
- Evidence growing that both N and P are important nutrients for control. Suggests that dual nutrient control strategies are warranted
- Current Action Plan calls for N reductions, but many processes under way will also remove some P
- No rationale for P reduction alone.

Subgroup 1 Charge:

A. Address the state-of-the-science and the importance of various processes in the formation of hypoxia in the Gulf of Mexico. These issues include:

i. increased volume or funneling of fresh water discharges

ii. changes in hydrologic or geomorphic processes

iii. increased nutrient loads due to coastal wetlands losses, upwelling or increased loadings from the Basin

iv. increased stratification, and seasonal changes in magnitude and spatial distribution of stratification and nutrient concentrations in the Gulf;

v. temporal and spatial changes in nutrient limitation, as significant factors in hypoxic zone formation;

vi. the implications of reduction of phosphorus or nitrogen without concomitant reduction of the other.

B. Comment on the state of the science for characterizing the onset, volume, extent and duration of the hypoxic zone.